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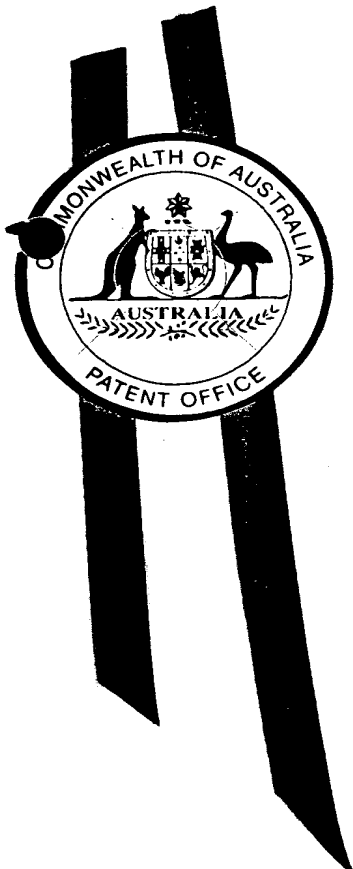
Patent Office  
Canberra

I, KAY WARD, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. PQ 4306 for a patent by QUICKWATER PTY LTD filed on 26 November 1999.

WITNESS my hand this  
Thirty-first day of March 2000

A handwritten signature in cursive script, appearing to read "K Ward".

KAY WARD  
TEAM LEADER EXAMINATION  
SUPPORT AND SALES



**PRIORITY  
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**APPLICANT:** QUICKWATER PTY LTD

**NUMBER:**

**FILING DATE:** 26 November 1999

**AUSTRALIA**

**PATENTS ACT 1990**

**PROVISIONAL SPECIFICATION**

**FOR THE INVENTION ENTITLED:**

**"A SEPARATOR"**

The invention is described in the following statement:

## A SEPARATOR

The present invention relates to a separator for separating particles from a fluid.

5 Often, the propeller of a marine craft is extended away from the stern of the marine vessel by out rigging which supports the drive shaft of the propeller by a bearing. The bearings are water cooled and lubricated by channels or grooves which extend through the bearing. The water used is that which the marine vessel is in. When the marine vessel passes through water in which sand has been disturbed, the sand particles can find their way into  
10 the lubricating grooves of the bearing. The sand particles are highly abrasive to the bearing which results in the bearing quickly becoming worn.

There is therefore a need to minimise the amount of sand or other abrasive particles from entering the lubricating grooves of the bearing.

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In accordance with a first aspect of the present invention there is provided a separator for separating particles entrained in a liquid, said separator including:

a sleeve adapted to be mounted over a rotatable shaft for forming a cavity therebetween;

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an inlet to the cavity;

an outlet to the cavity;

means for imparting a centrifugal force on fluid within the cavity and operatively connected to the shaft so that, in use, spinning of the shaft creates the centrifugal force,

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wherein, in use, a fluid carrying particles enters the cavity through the inlet, the particles are caused to separate from the fluid by action of the centrifugal force and the separated particles and fluid leave the cavity via the outlet with the particles tending to be closer to the sleeve than the shaft.

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Preferably, the cavity increases in cross-sectional volume along its length from the inlet towards the outlet.

In a first embodiment, the sleeve is frustoconical in shape with the narrow end of the cone at the inlet and the wide end at the outlet, whereby the size of the cavity increases along its length from the inlet to the outlet, which causes the movement of the slurry through the cavity to slow the further it progresses along the length of the separator, thereby increasing the centrifugal action on the fluid as it moves along the length of the separator.

In a second embodiment, the cavity is of a helical shape the helix shaped cavity, acting as said means so that as it is rotated, the centrifugal force is imparted on the fluid in the cavity. Preferably, the helical shape assists in moving fluid through the cavity from the inlet to the outlet.

In the first embodiment, the means for imparting a centrifugal force is in the form of one or more paddles projecting from the shaft into the cavity that cause the fluid to rotate about the longitudinal axis of the shaft as the shaft spins.

Preferably, the inlet is of a smaller area than the outlet and thereby limiting the amount of fluid that enters the cavity.

Preferably, the outlet includes a parting means arranged to partition an inner most layer of fluid substantially devoid of the particles from an outer layer of the fluid carrying the particles. More preferably, the parting means is in the form of a blade closely encircling the shaft.

In order to provide a better understanding, preferred embodiments of the present invention will now be described in detail, by way of example only, with reference to the accompanying diagrams in which:

- Figure 1 is a cross sectional side view of a separator in accordance with the present invention;
- Figure 2 is an end view as seen from X-X of the separator of Figure 1; and
- Figure 3 is a cross sectional side view of another embodiment of a separator in accordance with the present invention.

Referring to Figure 1, there is provided a separator 10 which includes a sleeve 12. The sleeve 12 is fixed to a propeller shaft 34. An outer wall of the sleeve 12 defines a cavity 18 between the outer wall and the shaft 34. The cavity has an inlet 14 at one end and an outlet 16 at another end. The outer wall is of a frustroconical shape with the narrow end of the cone at the inlet 14 and the wide end at the outlet 16. The inlet 14 is of less area than the outlet 16. The inlet 14 is of a size to allow a desired amount of a slurry of water and said particles to enter the cavity 18. The outlet 16 is of a size so that separated sand particles may be layered circumferentially on the separated water so that the separated water is adjacent the bearing lubricating groove entry.

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The separator is spaced on the shaft 34 as short distant before a bearing 30 on the shaft 34. The distance may be, for example, about 1 mm. The spacing allows the sand particles to be laterally ejected from the outlet 16.

15 Referring to Figure 2, the separator 10 includes one or more paddles or veins 20 that project from the shaft 34. The veins may also allow the sleeve 12 to be fixed to the shaft 34 by, for example, receiving grub screws 38. In this example, there are three veins, however any suitable number of veins may be used.

20 Referring to Figure 3, separator 10 includes a cylindrical sleeve 12 fixed to the propeller shaft 34. In this case the cavity 18 is in the form of at least one helix shaped channel 52. More than one channel may be used, such as three or four, but only one is shown in the diagram for convenience. The inlet 14 is in the form of a raceway having an inwardly directed projection 50. Only a small gap is provided between the projection 50 and the shaft 34. This is to limit the size of the particles entering the separator 10 and to limit the intake of fluid. The raceway may be detachable from the rest of the separator. After the gap, there is a circular cavity 51 that allows the fluid to flow freely before entry in to the channel 52. The channel 52 widens slightly so that there is minimal risk of particles becoming stuck in the channel and so that the flow rate of the fluid decreases. The widening in the channel is not shown. .

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The inlet 16 has a blade 54 surrounding the shaft 34 to partition the separated "clean" fluid

from fluid still carrying the particles. In this application only a small amount of fluid is required to lubricate the bearing 30, therefore only a small amount of clearance is required between the blade and the shaft. However this may vary for other applications.

- 5     The method of use and operation of the present invention will now be described with reference to the accompanying drawings.

The marine craft is propelled forward by propeller 36 mounted on the propeller drive shaft 34. In the first embodiment, the forward motion causes a slurry of water and sand and possibly other particles to enter the inlet 14 as shown by arrows A. In the second  
10     embodiment the helical shape of the channel draws the water and particles into the inlet 14. Large particles are prevented from entering the raceway.

When the slurry of water and particles enters the cavity 18 either the veins 20 or the helical  
15     shape cause the slurry to spin with the rotation of the shaft 34. The slurry continues to move along the length of the separator 10 either by forward motion, venturi effect described below or the helical shape. As the slurry moves along the length of the separator the widening of the cavity presents an increasing area to the slurry. This causes the flow of the slurry to slow. At the same time it is orbiting the shaft at approximately  
20     the speed of rotation of the shaft. Due to the orbiting motion, a centrifugal force acts upon the particles causing them to move closer to the sleeve than the water. This may be more pronounced in the second embodiment where the length of the cavity is greater than the distance between the inlet and the outlet due to its helical shape.

25     The particles move along the inside surface of the sleeve until they reach the outlet 16. Movement of the sand particles may be assisted by the sloping of the cone shaped sleeve. In the second embodiment, the blade provides a physical partition between the inner clean water and the outer slurry. The particles are ejected from the separator as shown by arrow B. Some of the separated clean water may enter the lubricating grooves 32 of the bearing  
30     30 at C. The remainder of the water will also exit the separator with the sand at B. The ejection of the particles and water may cause a venturi effect which causes the slurry to be sucked into and through the cavity 18. Once the water entering the bearing has passed

through the bearing grooves it exits at D.

The bearing may be modified so that it projects a short distance into the separator as shown by 40 in figure 1, this is thought to assist in the uptake of the separated water into the bearing and also assist in the ejection of the sand particles and corresponding venturi effect. The blade 54 in figure 3 may be considered a more sophisticated form of this.

It will be clear to those skilled in the art that the present invention has at least the advantage of reducing the occurrence of sand entering the lubricating grooves of the bearing, thereby reducing the wear on the bearing.

Modifications and variations will be apparent to those skilled in the art, such as the number of veins, the length of each vein and the length of the separator may vary provided that the slurry is caused to orbit the shaft and thus introduce the centrifugal separating effect on the sand particles. Such modifications and variations are intended to be within the scope of the present invention, the nature of which is to be determined from the foregoing description.

Dated this 26<sup>th</sup> Day of November 1999.

**QUICKWATER PTY LTD**

By Their Patent Attorneys  
**GRIFFITH HACK**

Fellows Institute of Patent and Trade Mark  
Attorneys of Australia

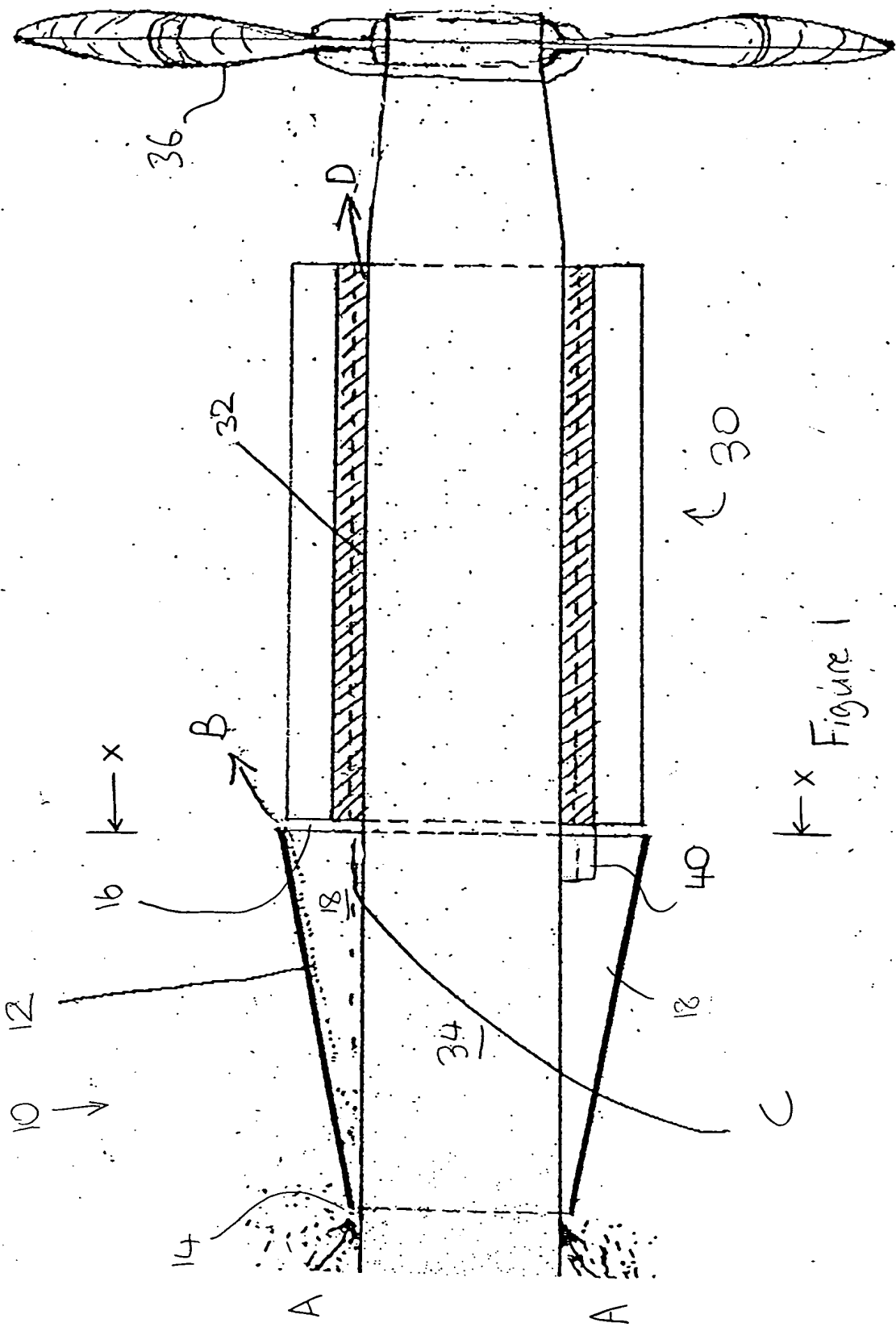


Figure 1

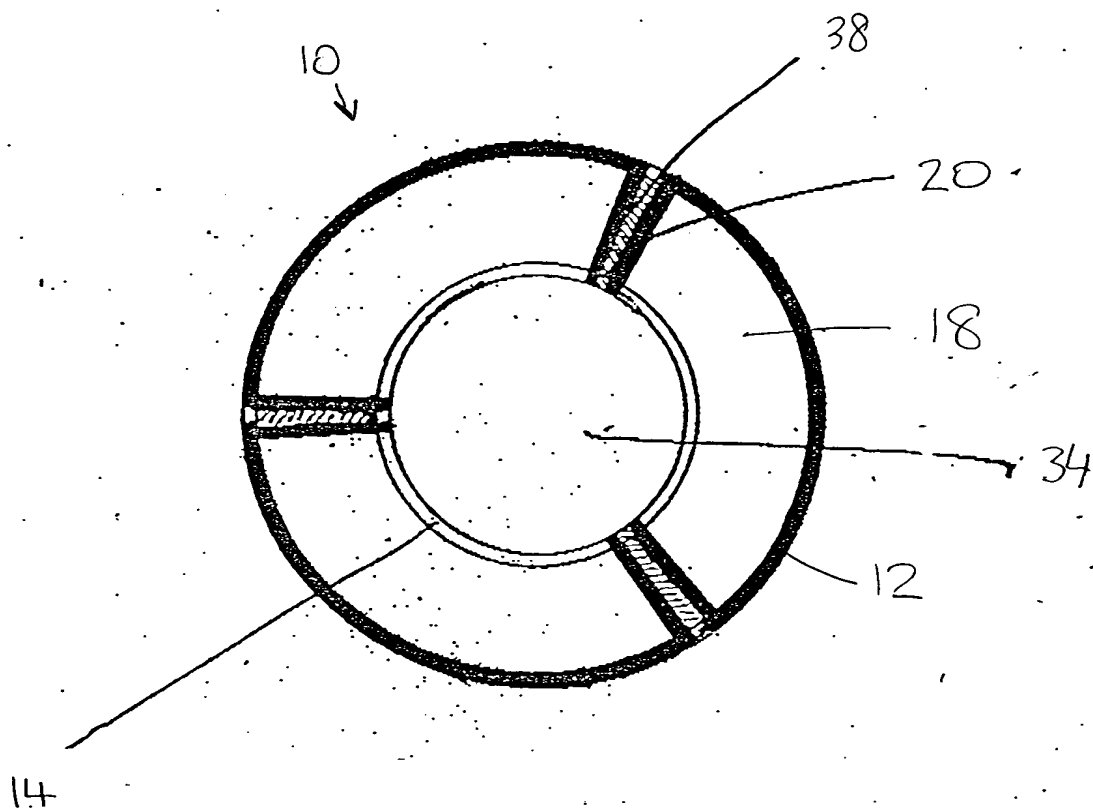


Figure 2

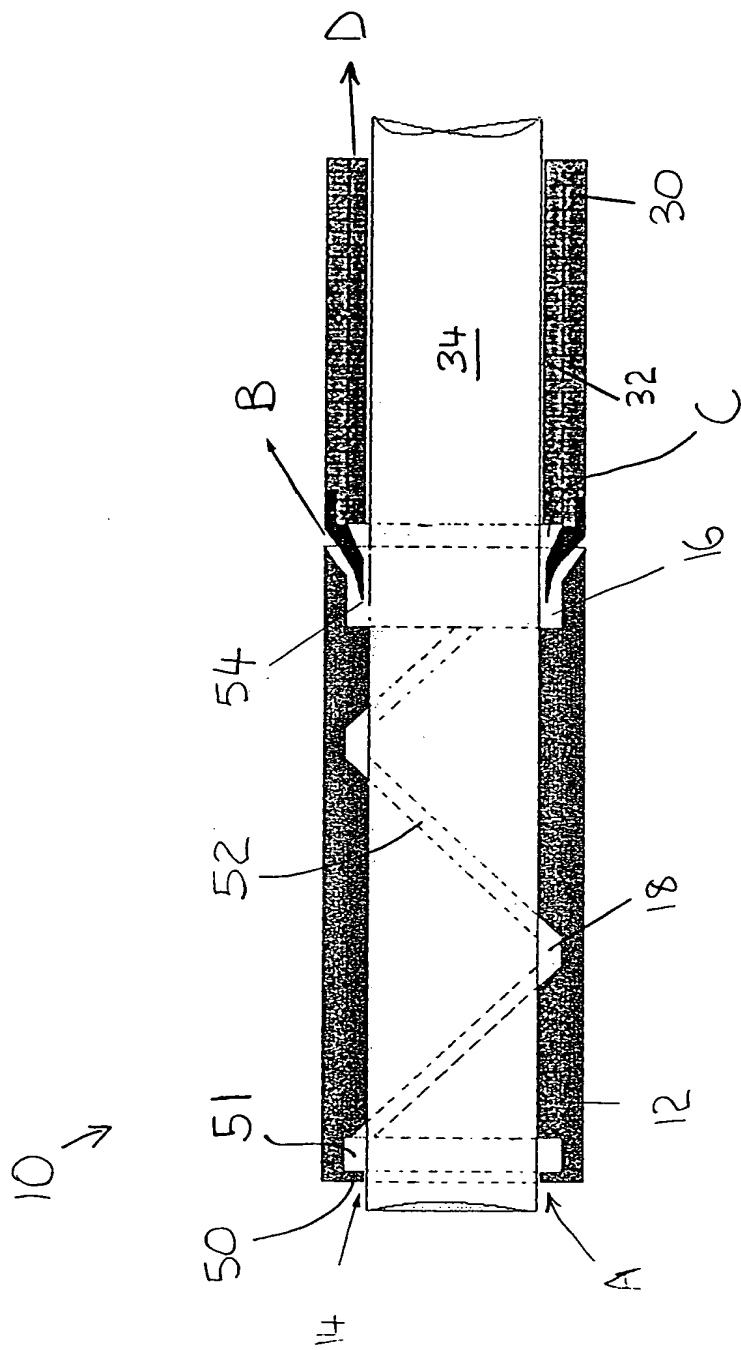


Figure 3